coordinated, and that such of the free-air observations made at the six primary stations to be operated by the Weather Bureau, as may be required, shall be made telegraphically available to the military authorities, supplementing similar observations made at the various military stations conducted independently by the Signal Corps. All the data secured at the Weather Bureau and the military stations will be turned over to the Weather Bureau for tabulation and study.

Five aerological stations, in addition to the one already maintained at Drexel, Nebr., are being established as rapidly as possible. One of these stations will be located at Ellendale, N. Dak., and the work in connection therewith has progressed to such an extent that it is expected that it will be in full operation before October 1, 1917. The sites for the other stations have been tentatively selected and the announcement of the exact location will be made later.

NORMAL ANOMALIES OF MEAN ANNUAL TEMPERATURE VARIATIONS.[1]

By H. ARCTOWSKI.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, §591.]

When mean daily temperatures are plotted to form an annual curve certain discontinuities are often observed. Attention has frequently been called to a sudden fall of temperature which often occurs in the spring, particularly in May or June, but it has not been so generally recognized that similar rises of temperature occur in autumn. These discontinuities suggest that the mean annual curve is formed of portions of several smooth curves, the transition from one to the next being brought about by a sudden change as shown in the figure [omitted]. These component curves have not necessarily all the same amplitudes, though in some cases they will be similar and the one simply be displaced up or down from the other. It is suggested that these changes from one curve to another may sometimes be due to a sudden change in the amount of atmospheric moisture above the station with a consequent alteration in the strength of the solar radiation received. There is evidence that the steps occur at approximately the same date at such widely separated stations as Baltimore, Md., in North America, and Barnaoul, in Siberia.—*J. S. Di*[*nes*].

STRUCTURE OF HAILSTONES OF EXCEPTIONAL FORM AND SIZE.[2]

By F. E. LLOYD.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, §594.]

A violent hailstorm of short duration at Carmel, Cal., [—, 1916], yielded large hailstones of unusual shape. Around a central core radiating arms projected having the form of icicles. It is suggested that the stones in the course of their formation were rotating, and thus the arms were built up by the throwing out of the water centrifugally. The suggestion is offered that when hailstones of exceptional type fall molds might be made by pressing plasticine around them before the ice has time to melt, and thus a permanent record of their shape would be obtained.—*J. S. Di*[*nes*].

[1] Amer. jour. sci., May, 1917, 43:402-409; Phil. mag., June, 1917, 33:487-495.
[2] Trans., Roy. Soc. Canada, Sept., 1916, 10:47-50.

IMPROVED METHODS IN HYGROMETRY.[1]

551.508.7 (048)

By A. N. SHAW.

[*Reprinted from* Science Abstracts, Sect. A, May 26, 1917, §365.]

A hygrometer of a type recently developed by E. K. Rideal and A. Hannah was tested and very satisfactory results obtained. In this instrument a known volume of the sample of air is drawn into the apparatus and the decrease in volume at constant pressure is determined after drying on sulphuric acid. The vapor pressure can be calculated in a few seconds from the reading of the instrument and the barometric pressure at the time. It was found that each observation required only from 2 to 4 minutes and an accuracy within about 1 per cent was obtained, whether the temperature and humidity were high or low.

The principle of a second type of hygrometer tested was based on the fact that certain salts will absorb water from the atmosphere in an amount which is closely proportional to the vapor pressure existing at the time. A clean filter paper moistened with a solution of P_2O_5 was suspended in a bottle from one arm of a balance. A constant stream of air was drawn through the bottle, and it was found that the humidity could be determined satisfactorily from the weight of the paper. The apparatus required to be calibrated by comparison with a standard method, but this once done the paper was found to remain without deterioration for a long time. A convenient form of the instrument can be constructed by hanging the paper from a sensitive spring balance in a tube open at both ends, the air circulation being maintained by a small pilot light in the top of the tube. The spring balance can be graduated to read in vapor pressure directly.—*J. S. Di*[*nes*].

551.57 (048)

FACTORS INFLUENCING THE CONDENSATION OF AQUEOUS VAPOR IN THE ATMOSPHERE.[2]

By A. MASINI.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, § 587.]

Experiments on the condensation of water vapor in the air under different conditions give the following results: The formation of the nuclei which, besides dust, may provoke the condensation of atmospheric aqueous vapor is determined specially by the presence of ozone, nitrogen peroxide, and indirectly ammonia. Electrical discharges, flames (independently of their fumes) and glowing bodies favor condensation in so far as the above substances are formed in their neighborhood. The property exhibited by some substances, of distributing fumes in the air, is identified with the phenomenon of deliquescence, the latter property being manifested without the surrounding medium being saturated with moisture. The conception of a medium saturated with vapor is, at any rate in practice, of relative and not absolute character. This relativity is implied by Kelvin's law, according to which the condensation or dew point depends not only on the vapor pressure but also on the radius of curvature of the surface of bodies in the immediate neighborhood of particles of vapor; it must now be extended to the consideration of the nature of these bodies and of their distance from molecules of the vapor.

Contrary to the conclusions of Lenard and Ramsauer, the action of the ultra-violet light is not necessary for the formation of the nuclei and functions only as a source

[1] Trans., Roy. Soc. Canada, 1916, 10:85-92.
[2] Nuevo Cimento, ———, Sept., 1916, 12: 110-129.

of ozone. Further, gaseous ions exhibit no power to constitute condensation nuclei, so that ionization of the air by either radioactive substances or Röntgen rays has not been shown to be a necessary or sufficient cause for the condensation of supersaturated aqueous vapor.

Trees, especially tall ones and those rich in resins, give rise to ozone, and should therefore favor production of rain. Opinions on the actual influence exerted by trees are, however, very variable.—*T. H. P[ope]*.

EVAPORATION OF MERCURY DROPLETS SUSPENDED IN A GAS.[1]

By A. SCHIDLOF & A. KARPOWICZ.

[*Reprinted from* Science Abstracts, Sect. A, Sept. 28, 1914, § 1569.]

The authors have previously experienced difficulty with experiements as to the value of the electron charge from the motion of mercury droplets between the plates of a condenser, in that the speeds of these drops become less with increase of time under given fields. They have now tried nitrogen as well as air between the condenser plates and extended the time to over an hour. The speed-time graphs slope down in the same way for each gas, the speeds becoming less and less as time goes on. The reductions in an hour's time are to about ½ in the case of air and to about ⅓ for nitrogen. It is also noticed that the droplets become more difficult to see as the experiments proceed. The conclusion adopted is that the droplets of mercury suffer evaporation under the action of the light.—*E. H. B[arton]*.

EVAPORATION AND ADSORPTION.[2]

By A. SCHIDLOF.

[*Reprinted from* Science Abstracts, Sect. A, July 30, 1917, §578.]

Gives a theory of the phenomena of continuous variation of the mass and of the density of drops of mercury maintained in suspension in a gas.

The hypothesis of molecular bombardment leads to the supposition of a film or layer of adsorption covering the surface of a liquid which is in the presence of a gas. The supposition of this layer of adsorption, combined with that of the molecular bombardment, suffices to explain the whole of the facts observed by A. Targonski.—*E. H. B[arton]*.

DYNAMICS OF REVOLVING FLUIDS.[3]

551.511 By LORD RAYLEIGH.

[*Reprinted from* Science Abstracts, Sect. A, Apr. 30, 1917, § 287.]

Meteorology depends ultimately so greatly on the mechanics of revolving fluids that the clear formulation of such simple conclusions as are within reach may be expected to guide the judgment when exact analysis seems impracticable. Aitken's recent paper on "The dynamics of cyclones and anticyclones" is taken as the starting point of the present inquiry, although the present author dissents in some respects from Aitken's views. The condition of symmetry round an axis is here imposed throughout, so that the fundamental equations are most appropriately expressed in terms of cylindrical coordinates, r,θ,z, the velocities u,v,w, being measured in the directions in which these increase. It is then shown that rv may be considered to move with the liquid, in accordance with Kelvin's general theorem respecting "circulation," provided that where V is the potential of extraneous forces, $P \equiv \int dp/\rho - V$, be independent of θ, which will be the case if ρ be constant or a known function of p, and P be single valued. The motion u,w, will then be the same as for $v=0$, provided we introduce a force v^2/r along r.

Case $u=w=0$.—Let gravity act parallel to z (measured downward) on a gas following Boyle's law. Then at a constant level p diminishes inward. But the resulting rarefaction will not cause ascent, inflow of the heavier part outside being prevented by the centrifugal force. The equilibrium of fluid revolving one way round in cylindrical layers between coaxial cylindrical walls will be stable only if the circulation increases with r, and neutral for the circulation constant. With a viscous fluid the stability will be unimpaired by rotation of the outer cylinder, but destroyed by rotation of the inner one. This does not conflict with Kelvin's condition of minimum energy that vorticity must increase outward ("Collected Papers," v. 4, p. 175), for he supposed operations on the boundary changing the moment of momentum, which is here constant. On the other hand, he maintains the strictly two-dimensional character of the admissible variations. But the passage from one two-dimensional state to another may be effected by variations which are not two-dimensional. Of course transition from unstable to permanent stable equilibrium is impossible without dissipative forces, as in the case of a heterogeneous liquid under gravity. But ordinary viscosity does not meet the requirements here considered, as it would interfere with the constancy of circulation. For purely theoretical purposes, however, there is no inconsistency in supposing the u,w, motion resisted while the v motion is unresisted.

Case $u=f(r,t)$, $w=0$ *or finite constant*.—Then P is independent of z, and the pressure is determined by the equation,

$$du/dt + udu/dr = -v^2/r - \mathrm{P}d\mathrm{P}/dr.$$

For an incompressible liquid r is determined by the equation of continuity $ur = \phi(t)$, and when u and the initial conditions are known, v follows. The motion, now two-dimensional, is conveniently expressed in terms of the vorticity, which moves with the fluid, and the stream function. For the former initially, and therefore permanently, constant throughout the fluid, the appropriate solution shows that if centrally the motion be one of pure rotation, as of a solid, the outer wall will close in, and, in addition to the pure rotation, the fluid will acquire the motion of a simple vortex of intensity, increasing as the radius of the outer wall diminishes. If the fluid be contained between two coaxial cylinders, both walls must move inward together, and the process will end when the inner wall reaches the axis; but the inner wall, or both, may be dispensed with, and the inflow at $r=r_1$ be supposed removed. It will then remain true that, if it thus pass at a constant pressure, the pressure at $r=r_2$ must continually increase. If a limiting pressure be reached, the inward flow must cease. Calculation of any more general case does not seem practicable, but it can be seen that when the u,w motion is slow relatively to the v motion a kind of equilibrium theory is approximately applicable, much as when the slow motion under gravity of a

[1] Comptes Rendus, Paris, June 29, 1914, 158: 1992-1994.
[2] Archives des Sciences, ———, Mar., 1917, 43:217-244.
[3] Proceedings, Roy. Soc., London, Mar. 1, 1917, 93:148-154.